

NASA-TM-109316

1-14

CONSTRUCTION COST CONTROL

- AFTER BIDDING -

by

JOSEPH ANDREW BROWN
CONSULTANT CONSTRUCTION COST ENGINEER
1682 VEGA AVENUE
MERRITT ISLAND, FLORIDA 32952

NASA CONSTRUCTION COST ENGINEER
DESIGN ENGINEERING DIRECTORATE, DD-FED-1
KSC HEADQUARTERS BUILDING, ROOM 3429
KENNEDY SPACE CENTER, FLORIDA 32899

TO BE PRESENTED AT THE

22nd ANNUAL AACE (AMERICAN ASSOCIATION OF COST ENGINEERS)
MEETING, SAN FRANCISCO, JULY 9-12, 1978

(NASA-TM-109316) CONSTRUCTION COST
CONTROL AFTER BIDDING (NASA) 15 p

N94-70591

Unclass

29/81 0190587

ABSTRACT

In these days where "Rising Costs Loom for Construction," energy shortages mean higher cost and escalation and multi-billion dollar projects such as oil and gas pipelines, nuclear power plants, and offshore platforms are more commonplace, cost control is becoming even more important for owners and contractors. In discussing cost control, it is important to first define it and explain the main tools used in controlling or managing costs. Some problems and solutions are

1. Materials costing more than estimated.
2. Labor costing more than estimated.
3. Computerized cost accounting and integrated cost control system.
4. Supervision costing three times more than estimated on a cost plus fixed fee job.
5. Change orders costing more than estimated.
6. Labor productivity too low.
7. Unit prices in cost control.

In addition to the above examples from my experience, some more were added at the AACE Florida Section panel discussion presented to the University of Florida's School of Building Construction, with over 180 in attendance.

The panelists were Phil Copare, Assistant to the Vice President of TYCO Constructors and formerly Supervisor of Construction of WDW; Tom Drawdy, State Estimates Engineer for Florida D.O.T.; Ed Hamm, Chief Cost Engineer, Greiner Engineering Sciences; Glen Wilhelm, Senior Cost Engineer, Davy Power & Gas; and myself as Panel Moderator.

INTRODUCTION

In these days where "Rising Costs Loom for Construction," energy shortages mean higher cost and escalation and multi-billion dollar projects such as oil and gas pipelines, nuclear power plants, and offshore platforms are more commonplace, cost control is becoming even more important for owners and contractors. Some problems and solutions are:

Problems:

1. Materials costing more than estimated.
2. Labor costing more than estimated.
3. Labor productivity too low.
4. Supervision costing three times more than estimated on a cost plus fixed fee job.
5. Change orders costing more than estimated.

Solutions:

1. Computerized cost accounting and integrated cost control system.
2. Unit prices in cost control, etc.
3. Good supervision and management.
4. Incentive.

In addition to the above examples from my personal experiences as a construction worker, estimator, construction engineer, teacher, consultant and cost engineer, some more, which I will discuss later, were added at the AACE Florida Section panel discussion presented to the University of Florida's School of Building Construction, with over 180 in attendance. The panelists were Phil Copare, Assistant to the Vice President of TYCO Constructors and formerly Supervisor of Construction of Walt Disney World; Tom Drawdy, State Estimates Engineer for Florida D.O.T.; Ed Hamm, Chief Cost Engineer, Greiner Engineering Sciences; Glen Wilhelm, Senior Cost Engineer, Davy Power & Gas; and myself as Panel Moderator.

The following discussion is based on my personal experience and opinion.

In discussing Cost Control, it is important to first define it and explain the main tools used in controlling or managing cost:

- A. Cost Control is a method or system used to record, compare, track and EFFECT the cost of a job or project for profitability.
- B. A Construction Management definition [from AACE C. M. Committee].

Cost Management (Cost Control) is the overriding of, recording of, manipulation of, and analysis of ALL COSTS pertaining to a project

in order to assure that a project does not exceed its feasible costs or budgetary allowances, and that the owner receives proper values for all monies expended.

C. Some main tools of cost control are:

1. The Detail Cost Estimate - [must be accurate].
2. The Plan and Schedule - Bar Chart to CPM Manual or Computer.
3. Combination Estimate and Schedule.
4. Cash flow [cash expenditure forecast].
5. Computer on large projects. Cost Accounting, Payrolls, etc.
6. Time-Lapse TV-Photographic.
7. Unit Price Contracts
8. Firm Fixed-Price Contracts [for subs, or labor, materials, etc.].

D. Cost Control and Cost Accounting - SHOULD BE REALISTIC, SIMPLE AND UNDERSTANDABLE.

E. Problems and Solutions

1. Material costing more than estimated:

a. During the summer of 1958, while a senior at the University of Florida in BCN, I applied for and received a part-time job for a Jacksonville PE contractor. I was a bit apprehensive but when I went to work he gave me the tedious job of going over the masonry invoices and totaling up the number of block used on a church school job. Apparently the block were costing more than estimated. While totaling up the cost and unit cost, I asked "Why are we paying a 3% sales tax on material, since I thought church schools were tax exempt." He looked at me startled and said "We aren't supposed to be." (paying the tax). So I called and got a credit for all the sales tax. I think that being observant and trying to analyze the cost of materials, whether they apply or not, is one of the factors that was responsible for my being offered and accepting a permanent job before my 1959 graduation from the University of Florida's School of Building Construction.

b. In 1961, during the construction of Orlando Girl's High School, our foreman, W. W. McFarland, found concrete costing more than estimated. He then found the quantity was more than estimated. He checked the concrete on the 2nd floor metal deck and discovered that the concrete supplier was not delivering full truck loads of concrete. We then confronted the supplier and after some discussion got a credit for the estimated overcharge, and our estimated cost vs actual cost came back in line.

Glen noted the importance of keeping class of bulk materials separate in estimating and cost accounting. They classify the steel in three major categories such as (1) 0-19 pounds per lineal foot; (2) Twenty to 39 pounds per lineal foot and (3) Forty pounds and over per lineal foot. These categories help keep the small angles separate from junior beams, and other large beams. He also said connections, detail piece parts, and hangars, etc., should be estimated and cost controlled separately because of their importance in estimates versus actual cost.

Another important part of materials cost is escalation. This part should be separate so there is not a double entry of cost for escalation by material supplier or subcontractor, or prime contractor. This was also pointed out on the Shuttle Runway bid when the low bidder asked all their subcontractors and suppliers to bid the job without escalation, since they figured on buying the job as soon as it was bid and getting all the materials, supplies, and equipment on the job so they could be paid for by the Government in their payment request, with little or no escalation needed. The low bidder was so successful that he finished the job 6 months early. I heard from the superintendent, who was a student of my BCC Plan Reading and Cost Estimating class, that this was a very profitable job for them. I also heard that they took lots of their major equipment to Alaska to build the 500 mile pipeline, which worked real well with their planning and scheduling.

2. Labor costing more than estimated:

a. Being the son of a plumber, I want to tell you that 30 years ago my Dad told me of an estimating problem about labor productivity which I haven't forgotten -- he said, in figuring a job, if I do it myself, I can set three plumbing fixtures (tub, toilet, and basin) in half a day -- but, if Elmer does it, it will take him a day to a day and a half or three times as long. Since then I worked with them as a plumber's helper during many hot Tampa summers and found out how true it was. I think of this story often and I am sure other Estimators know what I mean about labor productivity. Back then, I made \$.50 per hour as a plumber's helper; skilled mechanics were getting \$1.25 per hour. Now, \$8.00 to \$16.00 per hour is common for skilled labor. With this brief example of productivity and escalating costs, you can readily see its importance in estimating and cost control.

b. While doing part-time estimating (moonlighting) for a successful painting contractor (doing work all over the Southeast), I was again reminded of the importance of field supervision on cost control. In March 1967, after I had finished the purchase order for paint quantities, etc., for four Brevard Community College classrooms being built, my boss, Mr. Scott, said, "When I go out and paint with the crew as a working foreman, we complete the job for about one-third of the normal labor. When I leave the supervision to the foreman, we either lose money or come in and make a little, depending on how good a supervisor he is and how much he wants that extra incentive I give them for saving me money and making a profit. If I really want to make more money, I have to supervise them myself."

3. Labor productivity too low:

One of the most drastic approaches to a problem that comes to mind on the cost control of labor productivity is that of firing the whole labor force and shut the job down. This has been a satisfactory solution on two occasions - one as told to us at the AACE annual meeting and the other on a Florida section tour of construction project at Walt Disney World. Labor productivity too low is a major problem on many crash projects such as the construction of Walt Disney's World Theme Park and Lake Buena Vista, and the Alaska Pipeline, etc. Again, the importance of good field supervision and incentive by management, supervision, and yes, especially the craft labor.

4. Supervision costing more than estimated on Cost-Plus Contracts:

A subcontractor on the Contemporary Hotel at Walt Disney World came to me as a construction consultant with a problem. He was losing money on a cost-plus fixed-fee job. Can you imagine losing money on a cost-plus job? His fixed-fee was based on normal productivity for a 40 hour week. This job became a 7 day a week - two 12 hour shifts per day - with lots of C.O.'s etc. His labor productivity went to hell - his supervision and overhead included in his fee increased threefold and yet his fixed-fee remained fixed. After a detail study, investigation, case history and justification proving "changed conditions," he was able to successfully renegotiate his contract and fee. However, the cost control became a bigger problem for the contractor and owner. In our panel discussion, Phil Copare mentioned that when a job becomes a crash project, the best thing is to get it done as quickly as possible and get on to a more profitable job because it is almost impossible to measure when this happens. Ed Hamm also mentioned a crash job they were successful with. It was a Government Radar Site. They bid on a (1) 60 day duration; (2) 30 day; (3) 20 day option, for completion. They moved their top people in and completed it in 20 days. The company doubled their income and supervision and management were compensated with a percentage of the profit as their incentive for on-time completion.

5. Change orders costing more than estimated:

On extras, if proposals are too high, owner can do work with own forces or add to forthcoming project and bid with other work. Some owners also use design to limit clauses in design contract. Phil Copare said, as a contractor, they try to get as much as they can on change orders. It depends on when they are issued because if it is issued too late, it can cost a lot more. From the owners point of view, one major change order comes to mind. A big one on the Operations & Checkout Building. Some of you may recall seeing this building on the 6 Million Dollar Man T.V. show September 1977. During the early part of 1964, while the contractor was building this \$8,000,000 facility, he was asked for his proposal for adding a third floor addition on it. His proposal was about \$2,300,000. The Government estimate was \$1,068,462. After unsuccessful negotiations, the Corps of Engineers got permission to competitively bid this project. As you can see from a copy of the Abstract of Bids dated 30 April 1964, the Government Estimate was very good compared to the two bids - \$1,012,800

and \$1,128,600. This points out the need to get the contractor's proposal before an owner gives him the Notice to Proceed so the owner can go out and get competitive bids if the change order negotiations are unsuccessful.

ABSTRACT OF BIDS - CONSTRUCTION				Sheet No. 1 of 1			
MILITARY JOB BIDS NO.				OFFICE			
ENG(NASA)-OR-176-64-47				U. S. Army Engineer District, Canal Zone Corps of Engineers Merritt Island, Florida			
DATE				OPENED			
3 April 1964				2:00 P. M. EST 30 April 1964			
ITEM NO.	FOR	GOVERNMENT ESTIMATE	BID NO. 2 - Low		BID NO. 1 - 2nd Low		
			ESTIMATE	ESTIMATE	ESTIMATE	ESTIMATE	
	Construction of Third Floor Addition NSC Operations and Checkout Building, NASA Merritt Island Launch Area, Merritt Island, Florida		H. J. High Construction Co. P. O. Box 5218 1015 W. Amelia Ave. Orlando, Florida		R. E. Carlson, Inc. P. O. Box 11179 St. Petersburg, Florida		
	Construction of Third Floor Addition NSC Operations and Checkout Building	1 Job U.S.	\$1,068,462.00	U.S.	\$1,012,800.00	U.S.	\$1,128,600.00
Prices are considered fair and reasonable based on a comparison with the Government Estimate and other competitive bids received.							

6. Computerized cost accounting and integrated cost control system:

a. Another progressive general contractor in Central Florida showed me his successful computerized system developed with his cost accountant which was based on bi-weekly feedback on 30 cost items for each job - one for each major subcontractor and the labor and materials separate on the work he did with his own men tied to his payroll. This ties in real well with keeping it simple, realistic, and understandable.

b. One of the best integrated computerized cost control systems was discussed in Ed Faulkner's presentation at Florida Section AACE 5th Symposium on Construction Cost Engineering, January 22-24, 1975, at the Dutch Inn Lake Buena Vista. This system was for a large owner-builder building complex residential projects in the southeast. In this system, limits of variations were set and the computer automatically printed out those items in excess of those limits for ease of management review and action. One of the interesting guidelines was that an inspector would determine if framing was 0-1/4, 1/2, 3/4 finished, which was better than say 10% or 65%, which left too much to the inspector's judgement. I had some first-hand knowledge of this system, since I did some cost estimating for them. I worked with their Special Computerized Code of Accounts, which also served as an excellent estimating checklist.

Phil Copare said, at our panel discussion, no computer system for their "Mom and Pop" operation. They use a pencil and paper. Every Thursday night they write the checks and everyone gets paid on Friday. This was also true of the Jacksonville contractor, A. L. Clayton Co. where I worked from 1958-63. However, Ed Hamm said, in bidding \$10 to \$20 million dollar jobs, they needed the computer to get a good handle on the three

major costs; labor, materials and construction equipment. Labor costs are in manhours. They have 15 years of historical records to compare a bid's unit prices. This is especially important in civil site and road work. They couldn't afford to let a job get out of control. Their weekly reports have one thousand items per job and as many as ten jobs. One man and a pencil can't keep up with them. Glen also agreed that his company also needed computers on their jobs since they are so large and complex. Glen also pointed out the use of their cash expenditure forecast in their cost control system.

In 1963, when I was doing some estimating for another Jacksonville contractor, A. D. Allen, he showed me one of the most interesting estimating summaries I had seen. It consists of a 3-page project summary backed up with 10 pages of separate summaries for each major cost item such as overhead, site work, forms, concrete, masonry, rough carpentry, millwork, miscellaneous steel and metal specialties. These were all coordinated with a separate code of accounts, etc. This was also a simpler system but most of all it was coordinated between the cost estimator and cost accounting. Since then, many companies have come out with their cost control forms such as R. S. Means Co., and Frank R. Walker Co.

7. Units prices in cost control:

In designing and bidding the Kennedy Space Center's Space Shuttle Landing Facility bid, 3/8/74, a unit price was used for the 2,726,550 cubic yards of unclassified excavation due to the variation in estimating excavation. This helped NASA/KSC eliminate the contractor contingencies for variation in quantity in bidding the job and provided the Government a strong basis for negotiating additional excavation if an unforeseen site condition warranted it. This job was completed 6 months ahead of schedule and the cost growth during construction, due to design deficiencies was less than one-tenth of one percent (0.05%); and there were no claims for additional cost or time. See the enclosed abstract of bids for variations in Unit Prices and Total Bids. Item #1 was the Unit Cost for excavation, and Item #2 was the lump sum cost the the balance of the work. The low bidder was declared non-responsive because of an error in the amended quantity. The contract was awarded to Morrison-Knudsen.

Tom Drawdy's comment on the success the State of Florida, Department of Transportation, is having with most of its road work done by unit price, because it would be too difficult to handle the volume they do, especially with the amount of change orders they handle. Their success is good. In fact, you can track your cost better. It gives you a better data base, In fact, it is a necessity.

TASK I - CONSTRUCTION SPACE SHUTTLE LANDING FACILITY - KSC, FLORIDA PCN 75892

IFB No. CC 10-0035-4		Issued 1-10-74		Opened 3-8-74	
BIDDER	2,728,550 Cu. Yds.		JOB		TOTAL
	1-UNIT	1-ESTIMATE	2-ESTIMATE		
* Granite Construction Co. Watsonville, CA	0.75	\$1,700,775.00 [*] [2,044,912.50]	\$19,368,000.00		\$21,568,775.00 [21,912,912.50]
Morrison-Knudsen Co. Inc. Darien, Conn	0.80	2,181,240.00	19,631,497.00		21,812,737.00
Western Contracting, Corp Sioux City, Iowa	1.00	2,728,550.00	19,173,450.00		21,900,000.00
B.B. McCormick & Sons, Inc. Jacksonville, FL	1.35	3,680,842.50	20,306,050.00		23,986,892.50
Claussen Paving Co. Augusta, GA	1.60	4,362,480.00	20,537,000.00		24,899,480.00
Government Estimate	.86	2,344,833.00	22,756,047.00		25,100,880.00
Wiley N. Jackson, Co. Roanoke, VA	1.00	2,728,550.00	23,120,116.00		25,846,666.00
Kiewit-Zachary Joint Venture Cleveland, OH	1.00	2,728,550.00	23,915,000.00		26,641,550.00
Wright Contracting Co & Southern Road Builders Joint Venture Columbus GA & Augusta GA	1.05	2,862,825.00	24,600,000.00		27,462,825.00
C. W. Matthews Constr. Co. Inc. Marietta, GA	1.00	2,728,550.00	24,895,057.00		27,621,607.00
Hubbard-Smith Joint Venture Orlando, FL	1.28	3,489,984.00	25,338,332.00		28,828,316.00
Excavation Construction, Inc. Bladensburg, MD	4.16	9,433,632.00 [*] [11,342,448.00]	19,666,368.00		29,100,000.00 31,008,816.00
Macomb Concrete Corp. Fraser, MI	1.25	3,408,125.00	26,000,000.00		29,408,125.00

* Error unit price based on initial quantity of 2,267,700 cy unclassified excavation.

DESCRIPTION:

The work consists of the construction of: (1) a 15,000 foot by 300 foot wide, 16" & 15" thick concrete runway with a 1,000 foot overrun at each end to include approach, touchdown, high intensity runway edge, taxiway and centerline lights; (2) a 30,000 square yard parking apron; (3) a 9,150 foot towway from the runway to the vicinity of the Vehicle Assembly Building (VAB); (4) a 650 foot taxiway from the towway to the apron; (5) drainage systems; (6) approximately 1.5 miles of access roads; (7) electrical distribution system with associated cabling, switches, transformers, fixtures, and other equipment required to support the lighting systems; (8) airfield lighting vault; (9) water distribution system including approximately 7,000 feet of 12-inch water line and other miscellaneous piping, and (10) such other work as required to provide a complete facility in accordance with the plans and specifications.

F. Problems and corrective actions

In Dr. Fred Jelen's book, "Cost and Optimization Engineering," in the Chapter on Cost Estimation and Control, by J. F. Lovett, there is an interesting chart - Table 17.6T1, Control Problem Classification and Corrective Action Required. It shows 10 common problems and 28 solutions. Example Problem #6 - Inefficient use of Personnel. Solutions: (a) Provide more detailed work plan; (b) Increase supervision; (c) Increase or reduce work crew size.

Another interesting part of this Chapter in Cost Reporting calls for five broad categories of comparisons with the estimates:

1. Manhours expended vs actual accomplishment.
2. Calendar days expended vs actual schedule.
3. Estimated vs actual equipment cost commitments.
4. Actual items of equipment and materials vs project objective.
5. Quality of equipment and materials vs project objectives.

I might simplify this to:

1. Estimate labor cost vs actual labor cost for quantity of work accomplished.
2. Estimate material cost vs actual material cost for quantity of work accomplished.
3. Estimated equipment cost vs actual equipment cost for quantity of work accomplished.
4. Estimated or planned schedule vs actual schedule for work accomplished.

Table 17.6T1 Control-problem Classification and Corrective Action Required—Capital Costs

Control problem	Types of corrective action
1. Too early job start	a. Establish resulting extra cost b. Require that extra costs be justified
2. Lack of information	a. Make direct contact with information source b. Assign more personnel on temporary or permanent basis
3. Lack of personnel	a. Hire or rent additional personnel b. Adjust priorities to make personnel available c. Subcontract d. Use overtime
4. Lack of equipment, tools, or material	a. Expedite deliveries b. Reschedule to work around shortage c. Authorize vendor's overtime
5. Inefficient personnel	a. Provide more detailed work definition b. Increase supervision c. Adjust priorities to make more efficient personnel available
6. Inefficient use of personnel	a. Provide more detailed work plan b. Increase supervision c. Increase or reduce crew size
7. Inefficient work methods	a. Develop alternate methods b. Provide more detailed work plan c. Provide superior supervision
8. Oversights and additions	a. Allow minimum interference with project plan or schedule
9. Exclusion	a. Keep job on schedule b. Develop maximum labor efficiency
10. End-of-job stretch-out	a. Develop detailed checklist of cleanup work b. Develop detailed schedules for cleanup c. Reduce crew sizes promptly d. Eliminate maintenance or other work outside the objectives e. Expedite management decision to terminate construction

G. Development of new construction methods and time-lapse.

Another important tool in cost control is time-lapse. According to Henry W. Parker's Technical Report #51, "Methods Improvement Techniques for Construction and Public Works Managers" under Steps to Improvement, he says:

"Development of a new method by means of methods improvement techniques is a four-step procedure. The techniques or tools to accomplish the four steps would include (but not be limited to) those listed.

1. Record the job as it is being done, by
 - a. Visual observation.
 - b. Stopwatch studies.
 - c. Time-lapse photography & time-lapse T.V. system.
2. Analyze every detail of the present methods, using
 - a. Analytical deliveration.
 - b. Flow process charts
 - c. Crew balance studies.
3. Devise new methods.
 - a. Ask "Why, what, where, when, who, how?"
 - b. Hold round-table discussions.
 - c. Solicit ideas from management, superintendents, foremen, and tradesmen.
4. Implement the better method.
 - a. Sell the idea to boss and workmen.
 - b. Put the new method into practice.

All of these steps are very simple and most construction managers are sure they follow them informally at all times. Others realize that improvements can always be made, but are content with good enough. To the former, a methods improvement study would demonstrate the fallacy of his assertion; to the latter, a study would demonstrate the ease of making improvements."

According to demonstrations I have seen, time-lapse also may increase productivity and profits by

1. Cost-cutting work studies.
2. Crew sizing.
3. Legal purposes as indisputable evidence.
4. Keeping the head office staff informed of job progress and problems.
5. Pointing out safety hazards to crews.
6. Cost feedback for estimating.
7. Trading methods between offices.

Construction methods is an especially important tool in cost control as was pointed out in my Technical Paper "How Does the Successful Low Bidder Get Low - and Make Money" where I discussed eight money-saving methods.

H. Slow moving cost control

"If you do not depend on your cost control system and investigate each problem it reveals, look out. Your cost control system should be the nerve center of a well-run contracting organization. It should be as simple as possible, meeting only your current needs but with the capacity to expand with your firm's growth.

"It must compare estimated expenses and projected profits to actual and remaining expenditures on each item of work. The system should raise a RED FLAG beside each item not meeting its projected profit, and lead directly to corrective action. Even though most problems that cost control turn up are minor, they must be investigated. A lot of little losses can add up to a catastrophe," said Mr. Irving M. Fogel, President, Fogel & Assoc. Inc., in his article in "Construction Methods and Equipment" "Signs on the Road to Bankruptcy," January 1977. He also said: "If you haven't reviewed each of the last jobs you completed, you have a problem."

I. The riddle of field cost reporting.

When I teach construction planning equipment and methods at Brevard Community College, I have found a one-act play that emphasizes cost control. The "riddle of field cost reporting" demonstrates the value of accurate field cost reporting to uncover problems on a job that could overrun costs and that also become viable data for future bidding. This one-act play unveils the development of three reports as follows:

Report #1 - Field Labor Report of Labor Distribution.

Report #2 - Labor Distribution for Type of Work.

Report #3 - Labor Cost Report Summary showing the Estimated Cost of Job at the reported Cost of Job for each code item.

The example of Report #3 (copy enclosed) provides concise data for the company executive to spot problems early enough to take corrective action before profit margins are eaten up. This one-act play has been most helpful in discussions with my students, resulting in them exploring with me other ways of problem identification and cost controls.

The same 1966 magazine has another interesting article "Cost Control - an Informed Client Can Make it Work."

In these days of pipelines, nuclear power plants and offshore pipelines, Walt Disney World, etc., the owner is becoming more involved in the cost control of cost-plus projects. This has been pointed out especially by Jim Bent of Mobil Oil in his AACE presentations on "Scheduling and Controlling Construction Subcontracts." Jim has said over the past 5 years in the USA there has been a tendency toward the transfer of construction work from prime contractors direct hire forces to local subcontractors. This is forcing the owners to also become more cost control conscious.

J. Conclusion

In conclusion, keep it simple, realistic, understandable and remember incentive, supervision and management are also important tools for more profitable cost management. For those of you who have different and better ideas, I challenge you to write about your case histories of successful cost control projects so we may all share our experiences to benefit mankind by more successful cost management and profitability.

References:

1. "Construction Cost Escalation and Labor Productivity - What we can do About it," presented to the 1st International Cost Engineering Symposium June 19-28, 1971, Montreal, Canada.
2. "How Does the Successful Low Bidder Get Low and Make Money?" Presented to the American Association of Cost Engineers at their 17th National meeting June 17-20, 1973, St. Louis, Missouri.

REPORT #3 LABOR COST REPORT

13

Week Ending: 6/25/65

Project: FIRST NATIONAL BANK

Code	Type of Work *	Estimated Cost of Job			Reported Cost of Job			Estimate Allowed
		Quantity	Unit Cost	Cost	Quantity	Unit Cost	Cost	
	EXCAVATION							
A-1	Protect Trees	4ea	10.00	40	4ea	7.75	31	40
A-2	Layout	1S		750	758	-	429	563
A-5	Mach Excav Pigs-Earth	400cy	1.75	700	510cy	1.59	813	700
A-6	Hand Excav Pigs-Earth	165cy	4.75	784	140cy	4.50	630	784
A-7	Hand Excav Trench-Earth	31cy	4.90	167	15cy	4.50	68	74
A-9	Backfill @ Grade Beams	259cy	2.45	635			-	-
A-10	Fine Grade - Slab	41000sf	.05	2050			-	-
	-Sidewalk	6134sf	.06	368			-	-
A-12	Rock Fill-Under Slab	210cy	2.00	421			-	-
A-14	Vapor Barrier- 6 Mil	45000sf	.01	450			-	-
A-16	Pumping *	1S	-	50			-	-
A-17	HAND EXCAV - ROCK	-		-	5cy	6.00	30	-
				6435			2021	2171
	DEPOSIT CONCRETE							
B-1	Deposit Pigs	194cy	1.80	349	160cy	1.23	197	288
B-2	Deposit Grade Beams & Pillars	260cy	2.90	754			-	-
		40ea					-	-
B-5	Deposit Slab on Grade	504cy	2.30	1159			-	-
B-7	Deposit Catch Basins	4ea	8.00	32			-	-
B-9	Deposit Sidewalks	76cy	2.10	160			-	-
B-10	Deposit Steps	3cy	8.00	24			-	-
				2478			197	288
	FORM CONCRETE							
C-2	Form Grade Beams & Pilast	19461sf	.45	8757	844sf	.90	761	380
C-6	Form Catch Basins	4ea	40.00	160			-	-
C-8	Form Slab Edge	10901sf	.40	436			-	-
C-10	Form Sidewalk Edge	19461sf	.30	582			-	-
C-14	Form Steps	901sf	.60	54			-	-
C-20	Bulkheads & Screeds	46501sf	.15	698			-	-
C-28	Wreck & Clean Forms	22581sf	.05	1129			-	-
				11816			761	380

Mr. Joseph A. Brown, CCE
Construction Consultant Cost Engineer
Design Engineering Directorate, DD-FED-1
Kennedy Space Center, Florida 32899



SUBJECT: "Construction Cost Control - After Bidding"

Mr. Joseph A. Brown is employed as Construction Cost Engineer for the National Aeronautics & Space Administration's Design Engineering Directorate. He prepares and reviews Government construction cost estimates amounting to over \$2 billion for design and construction. He is currently working on facility costs for requirements to meet future space exploration on the Space Transportation System. Mr. Brown received his formal education at the University of Florida. His major study was Architectural and Structural Design, Estimating, Management, Supervision, and Methods & Materials where he received a "BBC" Degree. Mr. Brown has completed courses in Management, Procurement, Contract Cost, and NASA PERT. He received a State and County license for Construction Cost Engineering July 1968. He has done consulting, estimating, and bidding for general and subcontractors for Commercial, Industrial, and Residential Complex Developers-Builders, covering Florida, California, Georgia, Alabama, and Walt Disney World's Contemporary Resort Hotel. He is the Past President and Charter Member of the Florida Section of American Association of Cost Engineers, AACE 1969 "Member of the Moment;" General Arrangements Chairman 1975 Annual Meeting, SAME' Canaveral Post's "Engineer of the Year," and NASA/Kennedy Space Center's "Federal Employee of the Year." September 14, 1976 he became the first CCE in Florida. He is writing an Estimating Workbook, "How to Sharpen your Bidding."